Western Avionics

MIL-STD-1553
Palm Pilot

Hardware / Software
User Manual

UM 11009 Rev A

13/14 Shannon Free Zone
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Ireland

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Introduction

The Western Avionics IIB-1553-PIU provides full MIL-STD-1553 test, simulation and bus analysis capability in a small, portable, hand-held unit, designed to utilize Palm Pilot technology as the operator interface. The unit provides support for 1553A, 1553B, McAir and STANAG 3838 variants in a self contained battery-operated unit, supplied with matching battery charger and power supply for desktop use.

The main 1553 hardware is supplied within a small, lightweight enclosure, and connected to a Palm PDA by means of the supplied HotSync cable. These two units operate together to provide a full MIL-STD-1553 test, simulation and bus analysis capability in a truly 'hand-held' and portable manner, allowing users to operate in remote locations and hostile environments with 1553 systems.

Main Features

The unit supports concurrent Bus Controller (BC) and up to 31 Remote Terminals (RT's) with Bus Monitor (BM). An additional Chronological Bus Monitor (CBM) facility is also provided, with comprehensive multi-level triggering capability. Full error injection capability is provided in BC and RT modes, with full error detection capability in BC, RT, BM and CBM modes. The unit provides a variable amplitude dual redundant 1553 interface, with 2 Mbytes of dual ported RAM. Code Warrior software is pre-loaded to the Palm Pilot unit, giving a user friendly GUI for all 1553 set-ups, data management and storage.

Manual layout

This document is split into three sections, Hardware, Preparation for Use, and Software. The Hardware section deals with the physical characteristics of the IIB-1553-PIU interface box, connectors, power requirements etc. The Preparation for Use section gives information on the interconnection of the PIU and PDA, connection of 1553 interface cables, and battery charging unit, and the Software section describes the Palm1553 user interface driver that resides in the Palm PDA.

HARDWARE

1553-PIU.

This section deals with the PIU unit itself, which is contained within a small custom built enclosure, as shown in Figure 1 below, which is connected to a Palm PDA using a standard RS 232 cable link, normally used for HotSync of the Palm PDA to a host PC system.



Figure 1: Assembled PIU

General Specifications

- ☺ MIL-STD-1553A/B, STANAG 3838 compatible
- ☺ MCAIR compatible
- ☺ 2 Mbytes Dual Port RAM (all modes)
- ☺ BIT and diagnostics
- ☺ All set-ups programmable in real time
- ☺ Programmable for Direct or TX coupling
- ☺ Programmable TX amplitude
- ☺ Full error injection (BC & RT)
- ☺ Full error detection (all modes)

Bus Controller

Programmable Tx amplitude
Programmable inter-message delay
Programmable RT response time
Programmable Frame frequency
Programmable message sequencing
Messages and data changeable in real time
Acyclic message insertion
BC-RT, RT-BC, RT-RT, mode code, broadcast
Multiple data buffering, all transmitted and received messages
Full error injection / detection

Remote Terminal

Multiple RT simulation (up to 31 RT's)
All sub-addresses selectable
Selectable Broadcast mode
Programmable Mode Code sub-address
Programmable Status word
Programmable RT response time
Message time tagging (32 bit @ 500 nSec)
All active RT tables changeable in real time
Data and Status words changeable in real time

Bus Monitor

All data buffers monitored
All data time tagged (32 bit @ 10 µSec resolution)
All data available for analysis
Programmable conditional triggers and masks
Message time tagging (32 bit @500 nSec resolution)
Store all, store only, store after modes
Full error detection capability

Palm Pilot Interface

RS 232 cable link

Power

Internal battery pack, Li-Ion, 4.1V, 5.2 Ah
Saft Type MP 176065
Run time on internal batteries, 8 hrs. min.

Physical Characteristics

Dimensions	200mm x 100mm x 50mm
Weight	480 grams

Environmental

Operating Temp.	0 – 50°C
Storage Temp.	-20 – 70°C
Humidity	5% – 95% Non-condensing
MTBF (MIL 217F)	156,218 hrs at 25°C (GB)

Preparation for use

Connections, PIU to PDA

The PIU is connected to the Palm PDA using the supplied interface cable, which connects to the PIU at the Input side, located on the bottom face of the unit, as shown on Figure 2. On this same end, the Power (On/Off) switch is located to on the right, with a Reset switch on the left, and the DC in socket to the left of this.

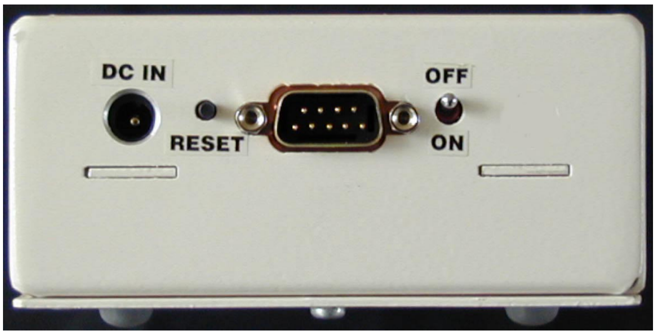


Figure 2:: Input Connectors

Connections, PIU to 1553 system

Connections from the PIU to the 1553 system are made at the top face of the PIU unit, as shown in Figure 3 below. Two sub-miniature tri-axial connectors (type BJ157) are provided for 1553 bus connections (Primary (J1) and Secondary (J2)) with conventional +ve 1553 signal wiring to the center pin, -ve 1553 to the outer ring. A 9-pin sub-miniature 'D' type socket connector (type SDES9SN) is also provided at J3 for signal I/O use. This 9-pin connector is wired as follows:

Pin number	Connection	Comments
1	WRITEPROT	Reserved, see Note below
2	TRIG-IN (ANODE)	Trigger input, anode connection
3	TRIG-OUT (COLLECTOR)	Trigger output, collector connection
4	GROUND	
5	EXT-TRIG (EMITTER)	External trigger, emitter
6	TRIG-IN (CATHODE)	Trigger input, cathode connection
7	TRIG-OUT (EMITTER)	Trigger output, emitter connection
8	NOT USED	
9	+5V	+5V, reserved, see note below

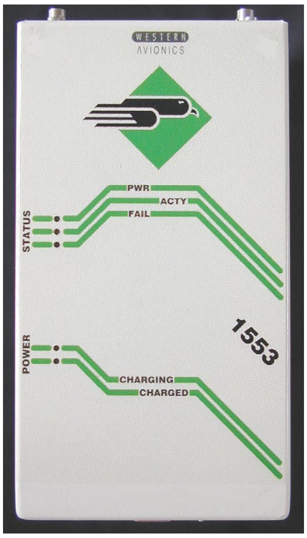
NOTE: Pins 1 and 9 are reserved pins that are used with factory furnished adapter, in event of firmware upgrades and modifications that may be supplied. Do not use these connections for any other purpose, as damage to the unit may result.



Figure 3: Output Connectors

Indicators

LED indicators are fitted to the front face of the PIU, and are positioned as shown below. The three Status indicators are, PWR (green LED) showing that the power supply and battery supply is healthy, ACTY (yellow LED) which indicates 1553 activity on the bus, and FAIL (red LED) showing a fault in the PIU. The two Power indicators show CHARGING (yellow LED) indicating that the unit battery is accepting a charge current from the battery charger unit, and CHARGED (yellow LED) indicating that the charging process is completed.



Power source

The PIU power source is a 4.1 volt, 5.2Ah Lithium Ion battery, Saft Type MP 176065, built into the base of the unit, which is charged through a charge management control circuit built into the PIU. Power is supplied to the charge management control circuit from the DC in socket shown in Figure 2, which when connected to the matching 6V DC power supply unit furnished, will enable the PIU to be run from the power supply directly, or enable the battery to be re-charged.

Power supply

The 6 volt power supply unit supplied with the PIU has been selected to provide optimum input voltage and supply current for the on-card battery charge management circuitry, and substitution of this PSU is not recommended. Should the user wish to use an alternative PSU, then this should be restricted to a 6 volt DC output type, as PSU's with supply voltages in excess of this value will cause undue heat dissipation within the PIU. Excessive temperature rise within the PIU will cause the battery charge cycle to be inhibited. This condition will be indicated by both the Charging and Charged LED's being on. Charging will remain inhibited until the temperature falls within pre-set threshold limits.

SOFTWARE

The Palm1553 user interface software resides on a Palm PDA and is used to fully control the operation of the IIB-1553-PIU interface box. The software can operate in any one of three modes:

- Bus Controller Mode
- Remote Terminal Mode
- Bus Monitor Mode

Changing of Global settings, saving setups and debugging can be achieved using a drop-down menu (see **Drop Down Menu Options**).

To invoke the Palm1553 software first ensure that the 9-pin D-type connector of the Palm HotSync cable is fitted to the IIB-1553-PIU box and that the box is turned on. Once this is done, select the Palm1553 LOGO on the Palm PDA screen. The LOGO will appear as outlined in Figure 4.



Figure 4: Palm1553 LOGO

Once the ICON is selected, the Palm1553 will be launched and the introduction page, as shown in Figure 5 will appear.

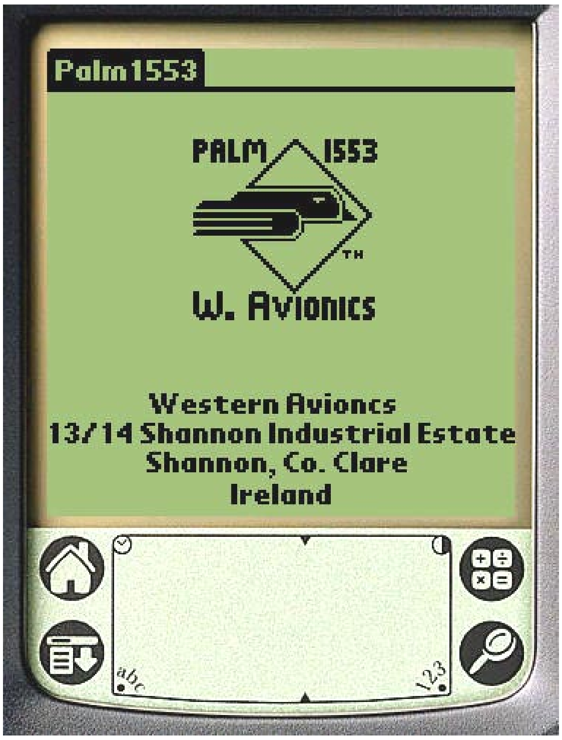


Figure 5: Palm1553 Introduction

To proceed, tap the screen with the stilo-pen. Alternatively, wait 10 seconds and the software will automatically proceed. At this point the Palm1553 software will start serial communication with the hardware and determine if the system has been initialized. If the hardware does not appear to be initialized (eg: the hardware has just been powered up), then the screen as shown in Figure 6 will appear. If the hardware has been initialized then the software will display the main operating screen as shown in Figure 7.

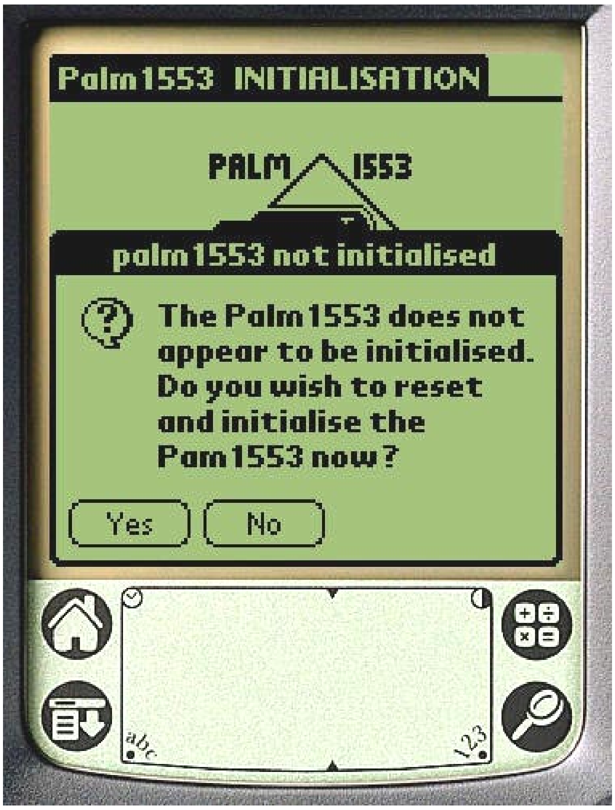


Figure 6: Palm1553 Initialization

Should the screen appear as shown in Figure 6, it is ***strongly*** recommended that the option 'Yes' be selected. Initialization will take approximately 40 seconds. This is a 'once only' requirement when the IIB-1553-PIU hardware has previously been powered down. Further launching of the Palm1553 software will detect that this operation has been previously executed. Once initialization is complete, the software will now display the main user menu as shown in Figure 7.

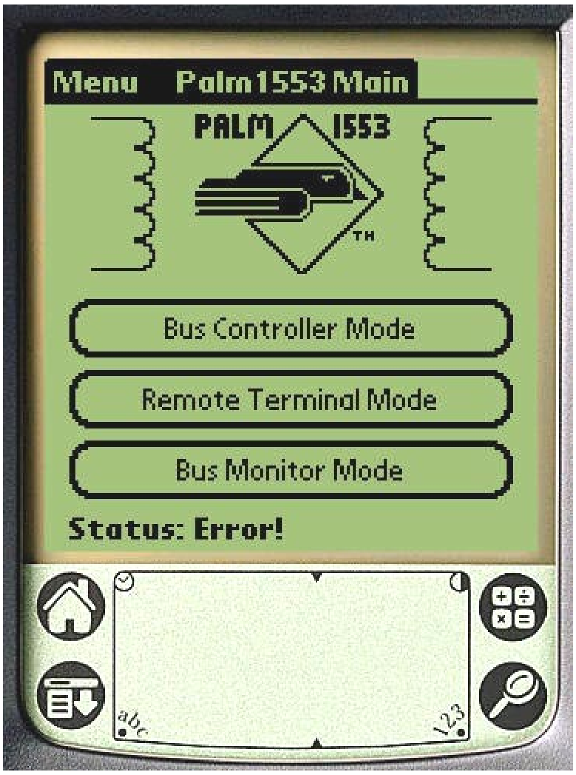


Figure 7: Palm1553 Main Menu

The '**Status**' at the bottom of the screen will indicate mode the hardware is in. If the system has just been initialized, the status should read '**SELFTEST PASSED**'. If the status is '**Error!**' as shown in Figure 4, there is a communication link error. In this case, ensure the HotSync cable is connected correctly.

The Palm1553 software automatically saves, in a database, critical global settings such as bus coupling, TX amplitude etc.

NOTE:
If this is the first time the software has been launched on the Palm PDA, see 'setups' in the **Drop Down Menu Options** of this document.

Once the global parameters are setup, tapping on the particular main menu button will choose the particular mode of operation.

- **Bus Controller Mode**
- **Remote Terminal Mode**
- **Bus Monitor Mode**

Bus Controller Mode

The main menu for the Bus Controller Mode is shown in Figure 8.

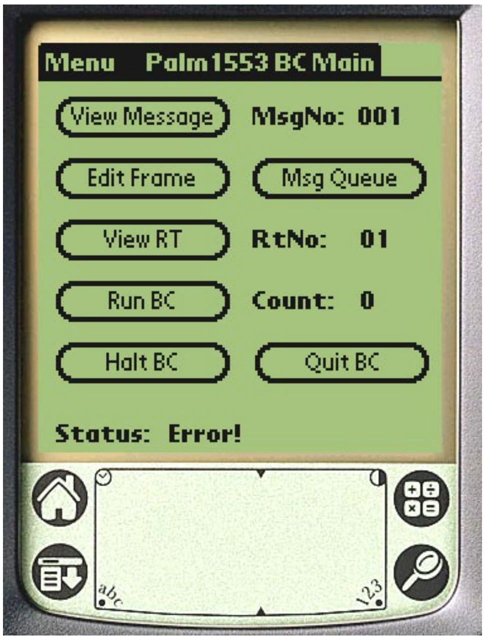


Figure 8: Palm1553 Main BC Menu

The main BC menu consists of the following:

View Message button:
This displays the setup page for the chosen BC message as defined in the **MsgNo** edit field. The user, to select 1 of 100 different messages, can change this edit field.

Edit Frame button:
This displays the setup page to select the messages and order for the frame to be transmitted.

View RT button:
This displays the setup page for the chosen RT as defined in the **RtNo** edit field. This edit field can be changed to select any RT from RT00 to RT31 (Broadcast).

Msg Queue button:
This displays the BC Message Queue report page. The queue will display any errors encountered during transmission.

Run BC button:
This button is used to start the BC transmitting the message frame. The **Count** edit field can be changed to select the desired number of frame transmissions. The range of this count is 0 to 60000. A count of 0 will cause the BC to transmit continuously until the Halt BC button is selected.

Halt BC button:
This button will immediately halt the BC at the end of the current message.

Quit BC button:
This button will quit the BC mode and return the software back to the main menu.

View Message

The BC message page is shown in Figure 9.

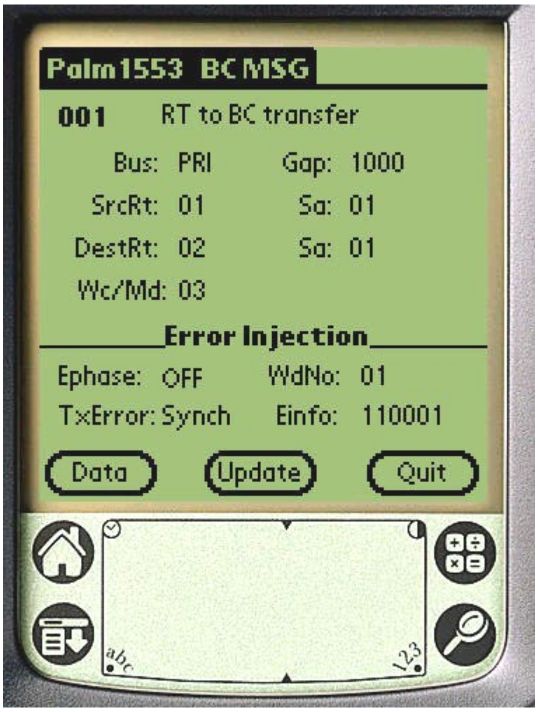


Figure 9: Palm1553 BC Message Page

The BC message page will display the message number as selected in the main BC menu page. The BC message consists of the following:

Message Type Field:

Tapping on this field will scroll the various message types available. The possible message types are as follows:

Text field	Description
BC to RT transfer	Standard BC to RT data transfer
RT to BC transfer	Standard RT to BC data transfer
BCST mode without data	Broadcast mode code without associated data word
BCST mode without data	Broadcast mode code with associated data word
BCST RT to RT transfer	Broadcast RT to RT data transfer
BCST BC to RT transfer	Broadcast BC to RT data transfer
Mode without data	Standard mode code without associated data word
Mode with data	Standard mode code with associated data word
RT to RT transfer	Standard RT to RT data transfer

Bus Field:

Tapping on this field will toggle the two options for transmission PRI (TX message on Primary bus) or SEC (TX message on Secondary bus).

Gap Field:

This field defined the inter message gap time in microseconds to follow the message. This field can be edited and must be in the range 4 to 6000 microseconds.

SrcRt Field:
This field defines the source RT number when data is to be from an RT to the BC or another RT. This field can be edited and must be in the range 0 to 31. The subaddress of this RT is defined in the **Sa** field to the right hand side of the SrcRt field.

DestRt Field:
This field defines the destination RT number when data is to be from the BC or another RT. This field can be edited and must be in the range 0 to 31. The subaddress of this RT is defined in the **Sa** field to the right hand side of the DestRt field.

Wc/Md Field:
For non-mode code type messages, this field defines the word count for the messages. For mode code type messages, this defines the mode code number to be used.

Error Injection
Each message can have an error injected into it. The fields below the **Error Injection** line define the error as follows:

Ephase Field:
This field defines which phase of the message is to have the injected error. Tapping this field scrolls through the possible options:

Text field	Description
OFF	Error injection disabled
1	Inject error into the first transmission containing the command word
2	Reserved
3	Inject error in 1st status response (only applicable if simulating RT)
4	Inject error in 2nd RT-RT status response (only applicable if simulating RT)

WdNo Field:
This field defines the word within the phase for the error injection. This field can be edited and must be in the range 0 to 63. A value of 0 will result in the error being injected in the 1st word of the phase. For example, if the phase is 1 and the WdNo is 0, then the error will be injected in the command word.

TxError Field:
This field defines the error type to be injected. Tapping this field scrolls through the possible options:

No Err	No error injected
Parity	Inject a parity error into the word (force parity to even)
Synch	Transmit an illegal SYNC pattern for the word
ManErr	Inject a Manchester encoding error into the word
BitCnt	Transmit an illegal number of bits for the word
WngBus	Transmit the phase on the wrong bus (WdNo = don't care)
BthBus	Transmit the phase on both buses (WdNo = don't care)
WdCnt-	Transmit too few words (WdNo = don't care)
WdCnt+	Transmit too many words (WdNo = don't care)
RespTm	RT to respond with a unique time (overrides global response time)

Einfo Field:
This field can be edited and is used to define information about the error as follows:

Error	**Einfo usage**
No Err	No used
Parity	Not used
Synch	6 x 0.5uS pattern for sync. Eg: 111000 = Good command sync.
ManErr	Bit number for error. Eg: 8 = Manchester in bit 8 for word
BitCnt	Number of bits in word. Eg: 15 = 1 too few, 17 = 1 too many
WngBus	Not used
BthBus	Not used
WdCnt-	Number of words to subtract from the message
WdCnt+	Number of words to add to the message
RespTm	Unique RT response time in microseconds

Data button:
This displays the message data setup page for transmitting.

Update button:
Tapping this button will update the message in the IIB-1553-PIU box with the new settings. This can be done when the BC is transmitting, allowing dynamic updating of the message.

Quit button:
This button will quit the message page and return the software back to the BC main menu.

Edit Frame

The Frame page is shown in Figure 10.

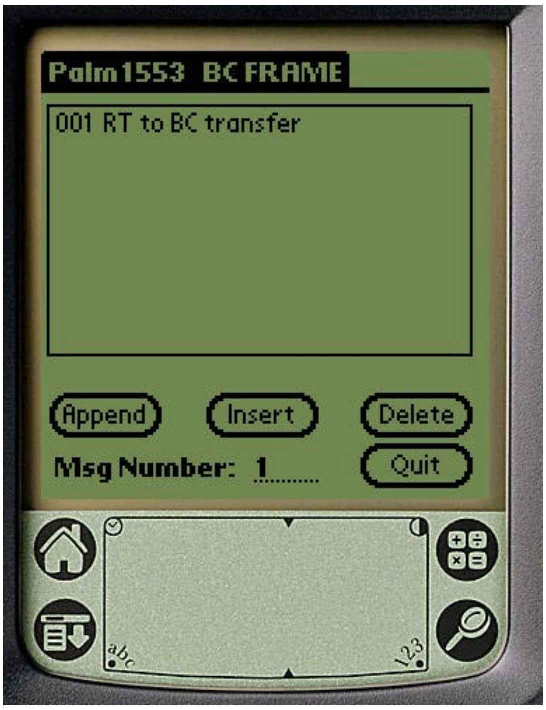


Figure 10: Palm1553 BC Frame Page

The BC Frame page allows the user to create the message sequence for the frame. Inserting, appending and deleting messages in the list box achieve this. The messages in the list box will indicate the message number (1 – 100) and the message type as defined in the message setup page. The editing of the message frame is done using four buttons:

Append button:

The message number (1 – 100) is first entered in the **'Msg Number'** edit field. Tapping the Append button will add this message to the end of the list.

Insert button:

The message number (1 – 100) is first entered in the **'Msg Number'** edit field. Now highlight a message in the list box. Tapping the Insert button will insert this message between the highlighted message and the previous message.

Delete button:

Highlight the message in the list box to be deleted. Tapping the Delete button will remove the highlighted message from the list.

Quit button:

This button will quit the frame page and return the software back to the BC main menu.

View RT

The RT page is shown in Figure 11.



Figure 11: Palm1553 RT page

The RT page is the same for both Bus Controller and Multi-Remote Terminal mode. The **RtNo** field indicates the RT address as defined in the main BC or MRT pages. The various parameters of the RT can be edited as follows:

Enabled:

This checkbox is used to enable or disable the RT. If the RT is disabled in MRT mode, the disabled RT will still store data from the BC and real RT in the subaddress data buffer. This allows disabled RTs to continuously monitor the traffic to any real RT active on the bus.

Status Word:

This field is a 4 digit hexadecimal number representing the RT status word. For enabled RTs, this can be edited and set to any value. The default value will be the expected RT status word with all bits cleared. If the RT is disabled, this value will be the last value sent by the real RT active on the bus. If the real RT failed to respond, this value will be set to 0xFFFF.

Last Cmnd:

This field is ‘read-only’ and will be the last command received by the RT.

Bit Word:

This field is a 4 digit hexadecimal number representing the RT BIT word. The RT will send the value of this word when it receives a TX BIT word mode code from the Bus Controller. This can be edited and set to any value.

Vector Word:

This field is a 4 digit hexadecimal number representing the RT VECTOR word. The RT will send the value of this word when it receives a TX VECTOR word mode code from the Bus Controller. This can be edited and set to any value.

Update button:

Tapping this button will update the IIB-1553-PIU hardware with the values set on the page.

Read button:

Tapping this button will read and display the current values in the IIB-1553-PIU hardware.

Quit button:

This button will quit the RT page and return the software back to the BC or MRT main menu.

Msg Queue

The Message Queue page is shown in Figure 12.

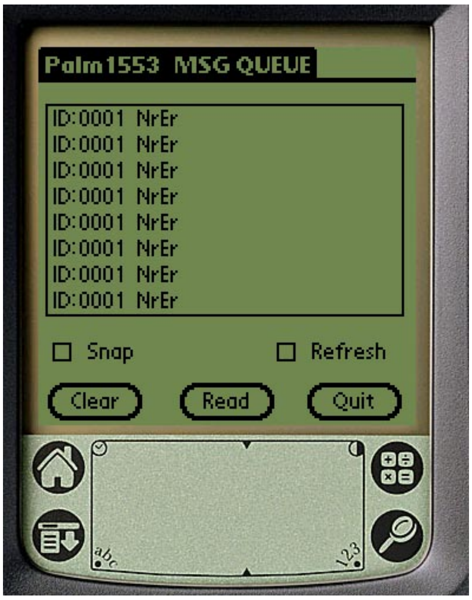


Figure 12: Palm 1553 Message Queue page

The Message Queue page is the same for both Bus Controller and Multi-Remote Terminal mode. The list box is 'read-only' and will contain any errors detected when the BC or MRT is active. When in BC mode, the ID for the error will be the message number in hexadecimal. When in MRT mode, the ID for the error will be the absolute address in memory of the look-up table position used by the message. The remainder of the list box entry will describe the error and can be one or more of the following:

BsErr	Wrong or Both bus transmission error
NrErr	RT failed to respond (RT no response error)
TaErr	Terminal address error (RT responded with incorrect address)
TxErr	Message contained an encoding error (Parity, Manchester etc.)
SyEr	Word transmitted with incorrect SYNC type

Clear button:
Tapping this button will clear the queue of all entries.

Read button:
Tapping this button will read the current contents of the queue and display it.

Snap:
If this checkbox is checked, the software will periodically read the contents of the queue and display it. This is the equivalent of tapping the Read button every few seconds.

Refresh:
If this checkbox is checked and the snap is enabled, the software will clear the queue of all entries after the period read and display of the queue. This is the equivalent of tapping the Read button and then the Clear button every few seconds.

Quit button:
This button will quit the Message Queue page and return the software back to the BC or MRT main menu.

Data pages

The Message data pages for the Bus Controller and Multi-Remote terminal modes are very similar. See Figure 13.

BUS CONTROLLER MULTI-REMOTE TERMINAL

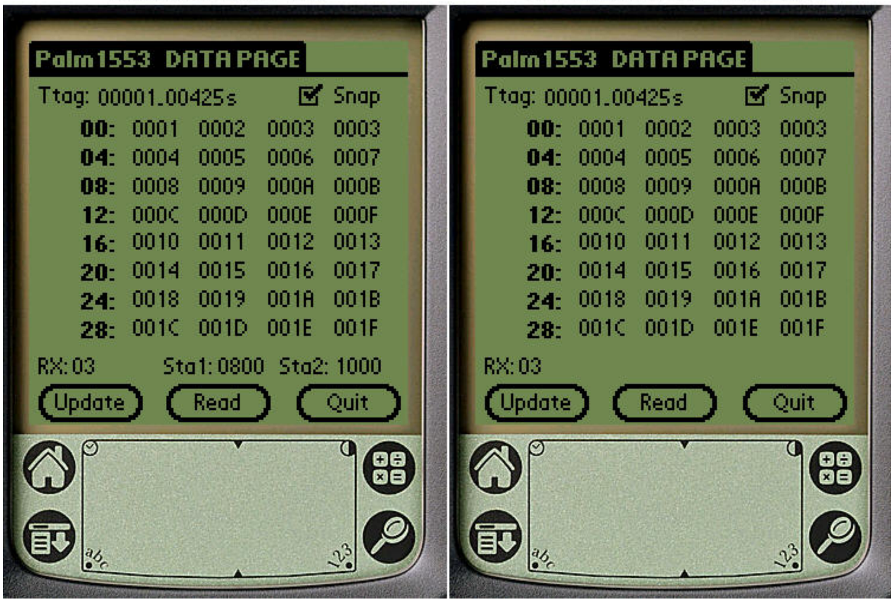


Figure 13: Palm 1553 BC and MRT Message data pages

The only differences in the two pages are the **Sta1** and **Sta2** fields. These are only applicable to the Bus Controller mode. These 'read-only' fields will display the last status word received from the RT due to this message. The second status field (Sta2) is only applicable if the message was an RT-RT transfer. The remainder of the page is identical and consists of the following:

Ttag:
This 'read-only' field displays the time tag value of the last message. This value is in seconds and has a resolution of 10 microseconds.

32 Data words:
The 32 data words are displayed in hexadecimal. When reading the data page, these fields will be filled with the current values in the 1553 hardware. These fields can be edited and written to the hardware using the Update button.

RX:
This 'read-only' field displays the number of words that were last received and stored in the buffer. If there message fails to send data the text Error will appear in this field.

Update button:
Tapping this button will update the 1553 hardware with the values set on the page.

Read button:
Tapping this button will read and display the current values in the 1553 hardware.

Snap:
If this checkbox is checked, the software will periodically read the contents of the data buffer and display it. This is the equivalent of tapping the Read button every few seconds.

Quit button:
Tapping this button will quit the data page.

Multi-Remote Terminal Mode

The main menu for the Multi-Remote Terminal Mode is shown in Figure 14.

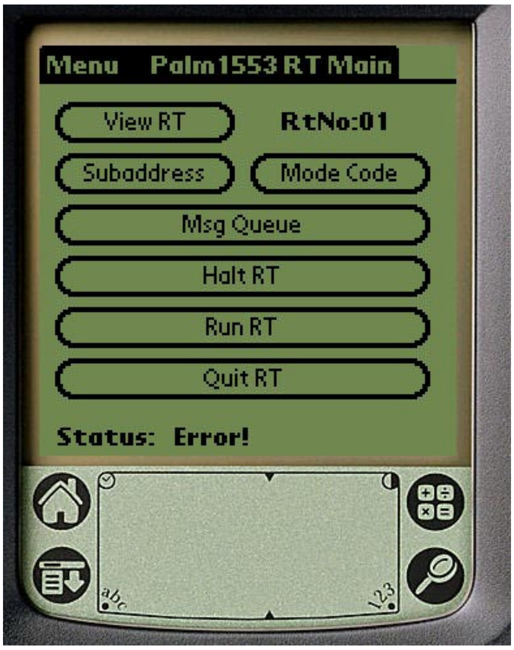


Figure 14: Palm1553 MRT Main Menu

The main MRT menu consists of the following:

Subaddress button:
This displays the subaddress edit page for the RT defined in the **RtNo** edit field.

Mode Code button:
This displays the mode code edit page for the RT defined in the **RtNo** edit field.

View RT button:
This displays the setup page for the chosen RT as defined in the **RtNo** edit field. This edit field can be changed to select any RT from RT00 to RT31 (Broadcast).

Msg Queue button:
This displays the MRT Message Queue report page. The queue will display any errors encountered during transmission.

Run RT button:
This button is used to start the MRT.

Halt RT button:
This button will immediately halt the MRT.

Quit RT button:
This button will quit the MRT mode and return the software back to the main menu.

Subaddress and Mode Code pages

The MRT Subaddress and Mode Code pages are very similar. See Figure 15.

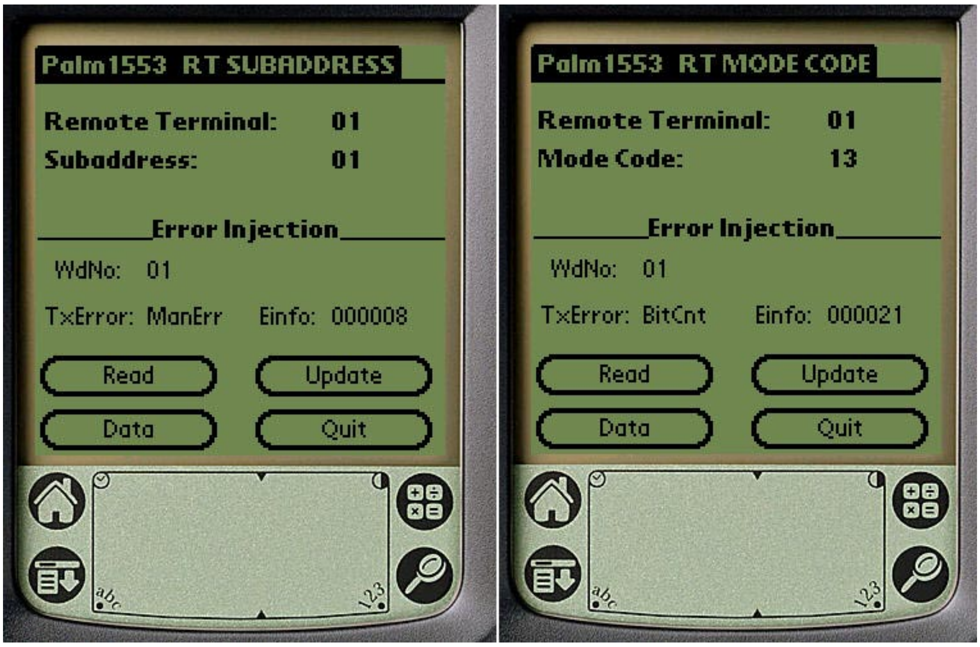


Figure 15: Palm1553 MRT Subaddress and Mode Code Pages

The MRT subaddress and mode code pages are used to inject unique errors in RT responses to particular subaddress and Mode codes. The **Remote Terminal** field is 'read-only' and is set to the RT number as defined in the MRT main menu. For Mode Code pages the **Mode Code** field can be edited to select the desired mode code number (0 – 31). For Subaddress pages the **Subaddress** field can be edited to select the desired RT subaddress number (1 – 30).

Error Injection

Each subaddress/mode can have an error injected into it. The fields below the **Error Injection** line define the error as follows:

WdNo Field:

This field defines the word for the error injection. This field can be edited and must be in the range 0 to 63. A value of 0 will result in the error being injected in the 1st word (Status word).

TxError Field:

This field defines the error type to be injected. Tapping this field scrolls through the possible options:

No Err	No error injected
Parity	Inject a parity error into the word (force parity to even)
Synch	Transmit an illegal SYNC pattern for the word
ManErr	Inject a Manchester encoding error into the word
BitCnt	Transmit an illegal number of bits for the word
WngBus	Transmit on the wrong bus (WdNo = don't care)
BthBus	Transmit on both buses (WdNo = don't care)
WdCnt-	Transmit too few words (WdNo = don't care)
WdCnt+	Transmit too many words (WdNo = don't care)
RespTm	RT to respond with a unique time (overrides global response time)

Einfo Field:

This field can be edited and is used to define information about the error as follows:

Error	Einfo usage
No Err	No used
Parity	Not used
Synch	6 x 0.5uS pattern for sync. Eg: 111000 = Good Status sync.
ManErr	Bit number for error. Eg: 8 = Manchester in bit 8 for word
BitCnt	Number of bits in word. Eg: 15 = 1 too few, 17 = 1 too many
WngBus	Not used
BthBus	Not used
WdCnt-	Number of words to subtract from the message
WdCnt+	Number of words to add to the message
RespTm	Unique RT response time in microseconds

Data button:
This displays the message data setup page for the subaddress or mode code.

Read button:
Tapping this button will read the current values of the subaddress or mode code from the IIB-1553-PIU hardware and display them.

Update button:
Tapping this button will update the message in the IIB-1553-PIU unit with the new settings. This can be done when the MRT is transmitting, allowing dynamic updating of the data and errors.

Quit button:
This button will quit the page and return the software back to the MRT main menu.

Chronological Monitor Mode

The main menu for the Chronological Monitor Mode is shown in Figure 16.

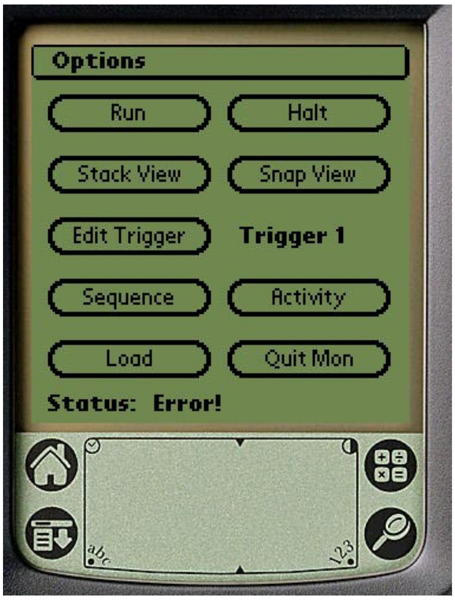


Figure 16: Palm1553 Chronological Monitor Main Menu

The main MON menu consists of the following:

Run button:
Tapping this button will start the monitor searching for the trigger condition and saving messages to the stack.

Halt button:
Tapping this button immediately stop the bus monitor recording data.

Stack View button:
This displays the data captured on the bus monitor stack.

Snap View button:
This displays a continuously updated display of the activity on the 1553 bus in the same format as the bus monitor stack page.

Edit Trigger button:
This displays the setup for one of the 4 triggers. Tapping the **Trigger** field selects which of the 4 triggers is to be edited.

Sequence button:
This displays the sequence setup for the trigger condition.

Activity button:
This displays a continuously updated display of the activity on the 1553 bus in a histogram format.

Load button:
Tapping this button will direct the software to load the trigger setup data into the IIB-1553-PIU hardware.

Quit Mon button:
This button will quit the MON mode and return the software back to the main menu.

Stack View and Snap View

The Stack and Snap pages are very similar. See Figure 17.

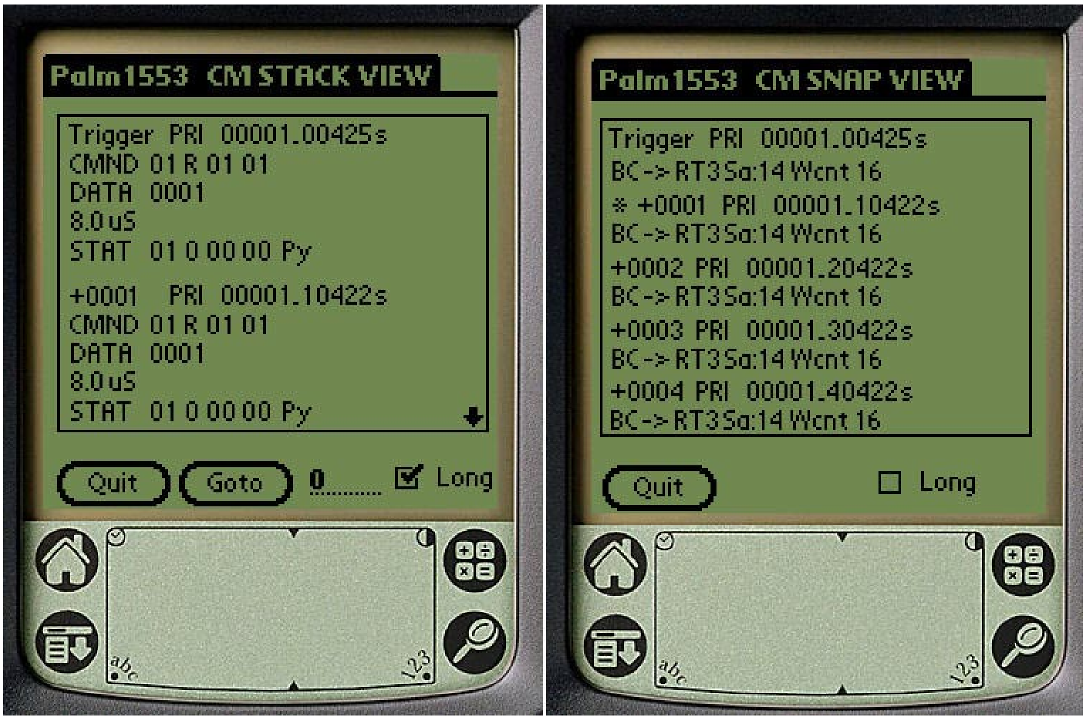


Figure 17: Palm1553 Chronological Monitor Stack and Snap page

The Stack and Snap pages are used to display the stack data. In both cases, the stack data is displayed in a list box in one of two formats. If the **Long** checkbox is checked, the format will be a **Long form:** detailed description of the message. If the **Long** checkbox is not checked, the format will be a **Short form:**, describing each message in two lines of text.

The **Stack View** is used to display the stack data after the bus monitor has captured data and has halted. This data is displayed in the list box and can be scrolled through using the list box up and down arrows. To speed up searching through the stack data, a **Goto** button is provided to direct the list box to a particular message in the stack. The edit field to the right of the **Goto** button can be used to select a particular message number in the stack. Tapping the **Goto** button will direct the software to search for the message number and fill the list box starting at this point in the stack. A value of 0 represents the message where the trigger condition was met. As the trigger may not have been the first message captured, negative numbers are allowed to display pre-trigger data.

The **Snap View** continually loads the trigger condition into the hardware, runs the monitor and when capture is complete, displays the data, starting at the trigger message, in the list box. There is no **Goto** function for the Snap View page.

Long form:

The example given for the Stack View in Figure 17 shows a typical long form display. Here each word is displayed on a new line giving the value and any errors associated with that word. Each message is given a signed number representing its position on the stack. Negative numbers represent pre-trigger data and positive numbers represent post-trigger data. The trigger message (0th message) is indicated by the text **Trigger**.

Following the message number is the bus ID indicator. This indicates the bus the message was received on and can be one of three values: PRI (Primary bus), SEC (Secondary bus) or BOTH (Message received on both buses).

The first line finishes with the time (time-tag) the message arrived.

Each word is preceded by a word type field. This can be one of four values:

CMND	Command word
RTRT	2nd Command word of an RT-RT transfer
STAT	Status word
DATA	Data word

The format for COMMAND/RT-RT COMMAND words is: **AA Y SS WW**

AA	5 bit RT address field in HEX format
Y	Transmit or receive bit and will appear as 'T' or 'R'
SS	5 bit Subaddress/Mode code field in HEX format
WW	5 bit Wordcount/Mode Code number in HEX format

The format for STATUS words is: **AA M BB CC**

AA	5 bit RT address field in HEX format
Y	Message error bit and will appear as '1' or '0'
BB	5 bits representing the instrumentation, SRQ and reserved bits in HEX format
CC	5 bits representing the remaining bits of the status word in HEX format

The format for a data word is a 4 digit hexadecimal number.

in Figure 17 the RT responded in 8.0 microseconds.

Any word can have one or more errors associated with it. These will be displayed after the word. The possible values are:

Py	Parity error in word
Mn	Manchester encoding error in word
Lg	Word had too many bits (Long Word)
Sh	Word had too few bits (Short Word)
Wc	Wordcount error in message (incorrect number of data words in message
Nr	RT failed to respond (No Response)
Ta	RT responded with incorrect address field (Terminal Address Error)
Sy	Incorrect Sync type (Command/Status with Data Sync or Data with Command Sync)

Short form:

The example given for the Snap View in Figure 17 shows a typical short form display. Here each message is displayed in two lines. Each message is given a signed number representing its position on the stack. Negative numbers represent pre-trigger data and positive numbers represent post-trigger data. The trigger message (0th message) is indicated by the text **Trigger**.

Following the message number is the bus ID indicator. This indicates the bus the message was received on and can be one of three values: PRI (Primary bus), SEC (Secondary bus) or BOTH (Message received on both buses).

The first line finishes with the time (time-tag) the message arrived.

The second line describes the message in a simplified form. The possible messages are as follows:

Rt(a)Sa(b)->Rt(c)Sa(d)	RT to RT transfer where a,b,c,d are the RT and Subaddress values
MC Tx	Transmit type mode code
MC Rx	Receive type mode code
BC-> Rts	Broadcast BC to all RTs
RT(a)Sa(b)->BC	Rt to BC transfer where a,b are the RT and Subaddress values
BC->Rt(a)Sa(b)	BC to RT transfer where a,b are the RT and Subaddress values

The following text will vary depending on the message type.

If the message type is a mode code then **MdNo XX** will follow where XX will be the decimal mode code number for the message.
If the message type is not a mode code then **Wcnt XX** will follow where XX will be the decimal word count for the message.

If a '*' precedes the message number, this message has one or more errors associated with it.

The example in Figure 17 shows a BC to RT transfer where the RT number is 3 and the subaddress is 14. The second message is preceded by a '*' indicating that this message has one or more errors associated with it.

Edit Trigger

The Trigger page is shown in Figure 18.

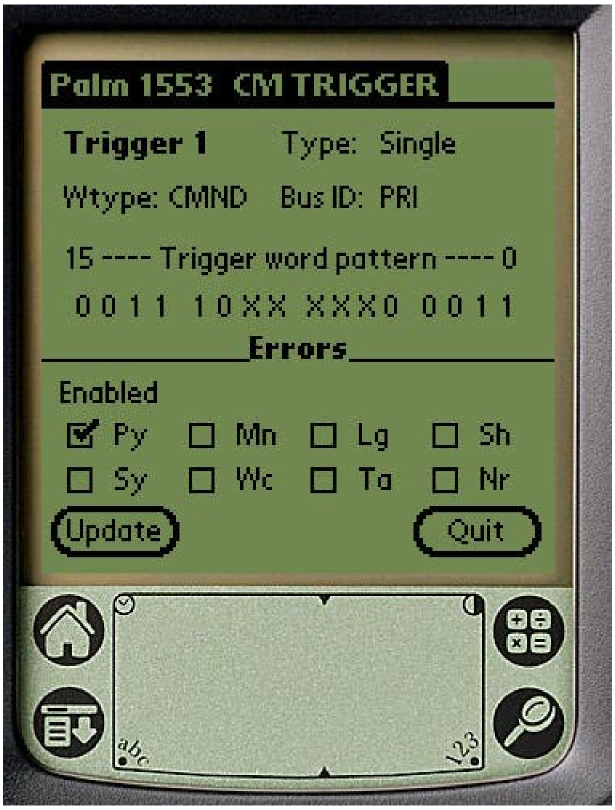


Figure 18: Palm1553 Chronological Monitor Trigger page

The Trigger page allows the user to define one of the four triggers. The top left hand corner of the page will display the trigger number, as defined in the Monitor main menu. This page consists of the following:

Type field:

Tapping this button will scroll the different trigger types that can be allocated to this trigger. The four types are as follows:

Single	Single Trigger. Can be used as an ARM for a WINDOW type trigger
Window	Window Trigger. Used to detect data within a message (follows a Single Trigger)
Selective 1	Same as a Single Trigger but used as an ARM for selective capturing.
Selective 2	Same as a Window Trigger but used to detect data within a message for selective capturing

A **Single** type trigger will continually look at each word until it finds the particular condition.

A **Window** type trigger will look for the trigger condition within the current message. If the trigger is met then the condition passes otherwise the condition fails. This is intended to be used as a following condition after a Single type trigger has passed it's condition. This allows specific events within a given message to be detected.

The **Selective** type triggers are very. However, if a message does not meet the criteria as defined by the triggers, the message will not be stored on the stack. This allows selective capture of particular messages.

For further details see **Sequence**.

Type field:

Tapping this button will scroll the different word types that can be allocated to this trigger. The five possibilities are as follows:

CMND	Trigger on a Command Word
RTRT	Trigger on Second Command Word of an RT-RT transfer
STAT	Trigger on a Status Word

DATA	Trigger on a Data Word
XXXX	Don't Care (Ignore the word type)

Bus ID field:
Tapping this button will scroll the different bus IDs that can be allocated to this trigger. The four possibilities are as follows:

PRI	Trigger on message on Primary Bus
SEC	Trigger on message on Secondary Bus
BOTH	Trigger on message transmitted on Both Buses
XXXX	Don't Care (Ignore the Bus ID)

Trigger Word Pattern fields:
Tapping these 16 fields allow the user to define the bit pattern of the word for the trigger condition. Each field will scroll through three possible bit states of 0, 1 and X. The 'X' is a don't care term.

Errors:
Tapping the top field will toggle the state of the error definition section to one of two states - **Enabled** or **Disabled**. If the state is Disabled, the errors associated with the word will not take part in the trigger condition. If this state is Enabled, then the trigger condition will only be met if one or more of the errors defined in the checkboxes occurs.

Error Checkboxes:
The checkboxes at the bottom of the page define the errors to be included in the trigger condition. If more than one error is checked then they will be a logical 'OR' (if any of the selected errors occur then the trigger condition is met). The checkbox errors are:

Py	Parity error in word
Mn	Manchester encoding error in word
Lg	Word had too many bits (Long Word)
Sh	Word had too few bits (Short Word)
Wc	Wordcount error in message (incorrect number of data words in message
Nr	RT failed to respond (No Response)
Ta	RT responded with incorrect address field (Terminal Address Error)
Sy	Incorrect Sync type (Command/Status with Data Sync or Data with Command Sync)

Update button:
Tapping this button will send the present trigger settings to the hardware.

Quit button:
Tapping this button will return the software back to the monitor main menu.

Example:
The example in Figure 18 defined the Trigger as follows:

- Single type trigger
- Trigger on a Command Word received on the Primary Bus
- The bit pattern of the Command Word must be an RX message to RT7 with a word count of 3. The subaddress is **don't care** (00111 0 XXXXX 00011)
- This word must also have a Parity error

Sequence

The Sequence page is shown in Figure 19.

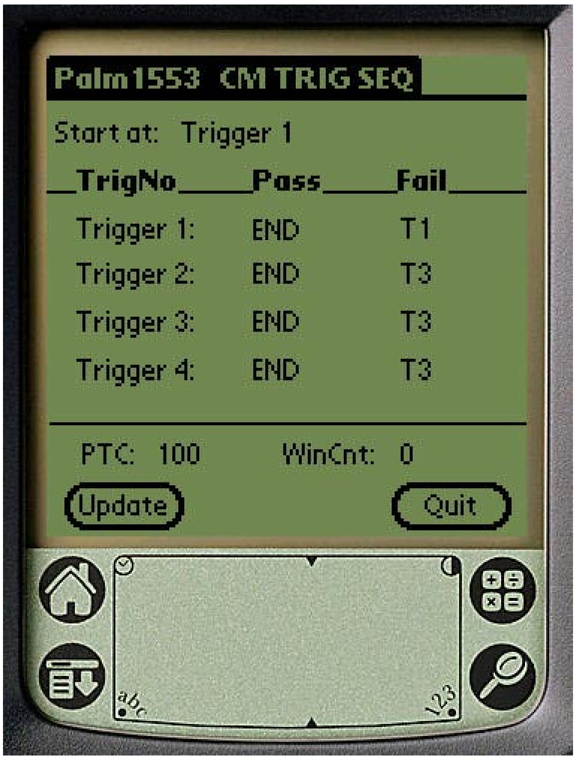


Figure 19: Palm1553 Chronological Monitor Sequence page

The Sequence page defines the sequence of events for the trigger condition to be met. This page consists of the following:

Start at:

Tapping this field will scroll through the four possible triggers that the sequence can start at.

Pass/Fail:

For each trigger, it is possible to define the next trigger to be used when it's own trigger condition passes or fails. Tapping on the Pass and Fail fields will scroll through the five options:

T1	On Pass/Fail go to Trigger 1
T2	On Pass/Fail go to Trigger 2
T3	On Pass/Fail go to Trigger 3
T4	On Pass/Fail go to Trigger 4
END	On Pass/Fail trigger is complete – do the post trigger count

PTC:

This field can be edited and is used to define the number of messages to save on the stack after the trigger condition is met. If this value is set to 0, the bus monitor will continually capture data until the hardware is commanded to halt.

WinCnt:

This field is for Window/Selective2 type triggers.
This field can be edited to define the word number within the message, the trigger interrogates. If this value is set to 0, the trigger will interrogate all the words within the message.

Update button:

Tapping this button will send the present sequence settings to the hardware.

Quit button:

Tapping this button will return the software back to the monitor main menu.

Example 1:

The example shown in Figure 19 will do the following:

- The sequence will start with trigger 1 (assume trigger 1 is of type **Single**)
- Each word will be tested for meeting the condition as defined by Trigger 1
- If it is met (Pass = END), then 100 messages will be saved (PTC = 100) and then the monitor will stop
- If it is not met (Fail = T1), T1 will be used for the next word

This will result in the hardware looking for the first occurrence of T1 and then saving 100 messages.

Example 2:

A more complex Window type capture would be as follows:

Settings:

Start at:	Trigger 1	
T1 type	Single	
T2 type	Window	
WinCnt	3	
PTC	8	
Trigger 1:	Pass = T2	Fail = T1
Trigger 2:	Pass = END	Fail = T1

Here, the monitor will continually search for a word that meets the T1 condition (same as **Example 1**). Once this condition is met, the monitor will test to see if the 3rd word (WinCnt = 3) in the message meets the condition for T2. If this is true then the trigger condition will be met and 8 messages will be stored (PTC = 8). If this is false, then the search for the T1 condition will start again. This trigger searches for a particular condition in word number 3 of a particular message.

Activity

The Activity page is shown in Figure 20.

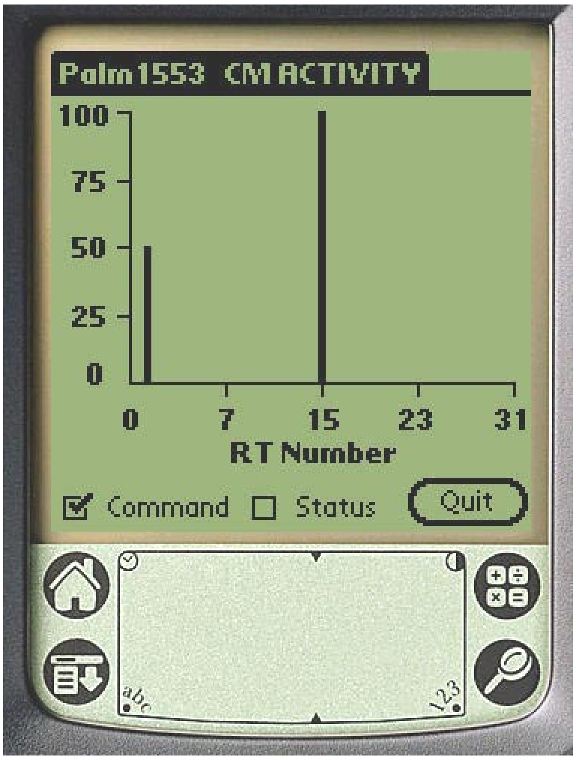


Figure 20: Palm1553 Chronological Monitor Activity page

The Activity page shows a statistical representation of the activity on the 1553 bus in Histogram form. The X axis is the RT Number and the Y axis is the percentage activity. In this page, the monitor is continually running and updating the histogram. The most frequently addresses RT will be set to 100%. All other RTs will be represented as a proportion of this activity. The example in Figure 20 shows that messages are being addressed to RT 1 and RT 15 only. RT 15 is being addressed the most (100%). The number of messages addressed to RT 15 is half the number of messages being addressed to RT 1 (50%). The **Command** checkbox is used to determine the BC activity. If the **Status** checkbox is checked, only RTs that respond with their Status Word will be represented.

Quit button:

Tapping this button will return the software back to the monitor main menu.

Drop Down Menu Options

When in any of the Main Menu pages, a drop-down menu is made available by tapping the '**Options**' text in the top left hand corner of the page. This will reveal a menu as shown in Figure 21.



Figure 21: Palm1553 Drop-down menu

The Drop-down menu consists of the following:

Reset System:
Tapping on this option allows the user to reset the hardware and initialize it to the default condition.

Debug Mode:
Tapping on the **Debug Mode** option allows the user to interrogate and edit the hardware memory and issue a series of set commands.

Setups:
When in the Palm1553 main menu, tapping on this option opens the **Global Settings** page.
When in the main menu of one of the three operating modes, tapping this option opens the **Mode Setups** page for getting or saving a setup.

About:
Tapping on this option will show an information box with the Rev level of the Palm1553 software.

Help:
Tapping on this option will show a simple help text box explaining the fundamentals of Palm1553.

Quit Palm 1553:
Tapping on this option will quit the Palm1553 application.

Debug Mode

Selecting the Debug Mode will display a further option box as shown in Figure 22.



Figure 22: Palm1553 Debug Options

The **Edit Data** button will display a page that allows the user to read and edit the hardware memory. The **Command** button will display a page that allows the user to command the hardware to execute a number of functions.

Debug - Edit Data

The Edit Data page is shown in Figure 23.

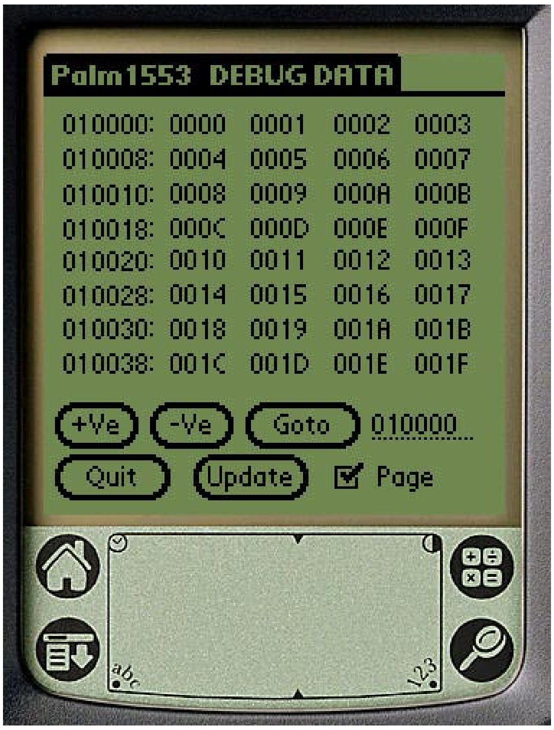


Figure 23: Palm1553 Debug Edit Data page

The Edit Data page allows the user to display and edit the current values of the memory in the hardware. The Edit Data page consists of the following:

32 word data page:

Each page consists of 32 x 16 bit words. Each word field is displayed in 4-digit hexadecimal and can be edited. The absolute byte address of the memory (2 Mbytes) for each line is displayed on the right hand side (in hexadecimal). In the example shown in Figure 23, the page address begins at 0x010000.

+Ve and –Ve buttons:

With the **Page** checkbox **not** checked, tapping these buttons will display the memory page starting at the next or previous 16 bit word respectively.

+Ve	Start address of page = Current start address + 2
-Ve	Start address of page = Current start address - 2

With the **Page** checkbox checked, tapping these buttons will display the next or previous memory page respectively.

+Ve	Start address of page = Current start address + 0x40
-Ve	Start address of page = Current start address – 0x40

Goto button:

Tapping this button will display the page starting at the address in the edit box to the right hand side of the button. This field can be edited. In the example in Figure 23 this address has been set to 0x010000.

Update button:

Changing the values of the 32 word fields does not directly change the memory in hardware. This button is used to transfer these changes to the hardware.

Quit button:

Tapping this button will return the software back to the main software menu.
Warning: The setup data and pointers for the hardware's DSP reside in this memory. Users without a good understanding of the hardware and the memory mapped registers, should **not** attempt to change any values.

Debug – Command

The Edit Data page is shown in Figure 24.



Figure 24: Palm1553 Debug Command page

The Command page allows the user to make the hardware execute a number of fixed commands. The Command page consists of the following:

Goto BC, Run BC, Halt BC buttons:

Force the hardware into BC mode, Run the BC and Halt the BC.

Goto RT, Run RT, Halt RT buttons:

Force the hardware into RT mode, Run the RT and Halt the RT.

Goto MN, Run MN, Halt MN buttons:

Force the hardware into MON mode, Run the MON and Halt the MON.

Load and Read Clock buttons:

Tapping the **Read Clock** button will display the current value of the clock in the text field on the right hand side of this button. The clock value will be displayed as an 8-digit hexadecimal number. Tapping the **Load Clock** button will load the value defined in the text field on the right hand side of the **Read Clock** button. This field can be edited. The user must enter the value to be loaded as an 8-digit hexadecimal number.

Create button:

Tapping this button will create a firmware upgrade database.
Warning: This function is password protected and is for Western Avionics use only.

Upgrade button:

Tapping this button will upgrade the firmware of the IIB-1553-PIU hardware unit with the upgrade database.
Warning: Western Avionics will provide any upgrade databases. The user must not attempt to upgrade firmware from any other source without first consulting Western Avionics.

SelfTest button:
This will command the hardware to execute a full selftest.
Warning: After this is complete, the hardware will **not** be initialized.

Reset button:
Tapping this button will physically reset the hardware and force it into a power-up selftest sequence.
Warning: After this is complete, the hardware will **not** be initialialised.

Quit button:
Tapping this button will return the software back to the main software menu.

Global Settings

When in the Palm1553 Main Menu, selecting **Setups** in the drop down menu will display the Global Settings page as shown in Figure 25.



Figure 25: Palm1553 Global Settings page

The Global Settings page is used to set up common parameters and options used in all modes. The Global settings page consists of the following:

Bus Coupling:

Tapping the text field to the right of the **'Bus Coupling'** label will toggle the 1553 bus coupling to one of two options:

Transformer	Transformer stub coupling
Direct	Direct coupling

TX Amplitude:

The text field to the right of the **'TX Amplitude'** can be edited to the desired 1553 TX amplitude. This decimal value must be in the range 0–255. This value is directly written to an 8-bt DAC for controlling the amplitude.

Response Time:

The text field to the right of the **'Response Time'** can be edited to define the global RT response time, in microseconds, to be used for all modes.

Response Timeout:

The text field to the right of the **'Response Timeout'** can be edited to define the global RT response timeout, in microseconds, to be used for all modes.

BC Frame Duration:

The text field to the right of the **'BC Frame Duration'** can be edited to define the Bus Controller frame duration in microseconds.

Comms Warning:
Tapping the text field to the right of the **'Comms Warning'** label will toggle this option ON and OFF. If set to 'ON', an alert box will appear if there is a communications error between the IIB-1553-PIU hardware and the Palm PDA.

Comms Delay:
Tapping the text field to the right of the **'Comms Delay'** label will toggle this option ON and OFF. If set to 'ON', the serial comms will slow down the data transfer by inserting time gaps between each byte transferred. This is for communication between a Palm PDA and a Western Avionics 1553 PCI card resident in a PC. For normal operation with the IIB-1553-PIU hardware unit, this should be set to **OFF**.

Sound:
Tapping the text field to the right of the **'Sound'** label will toggle this option ON and OFF. This option enables/disables the Palm PDA warning sounds.

Update button:
Tapping this button will read the contents of the Global Settings page and update the hardware with the new values. It will also save these values to the **Palm1553Init** database. Hence, the settings on this page are non-volatile and will be used every time the Palm1553 software is launched.

Quit button:
Tapping this button will return the software back to the Palm1553 main menu.

Mode Setups

When in the main menu of one on the three modes, selecting **Setup** from the drop menu will display the setup page for that particular mode. In all cases these setup pages allow the user to save particular setups for that mode in a database. This setup can then be restored for use at a later date. The **BC and RT Setup** page is identical. The **Mon Setup** page has further options to allow saving of setup data and stack recordings.

BC and RT Setup

The BC and RT Setup pages are shown in Figure 26.

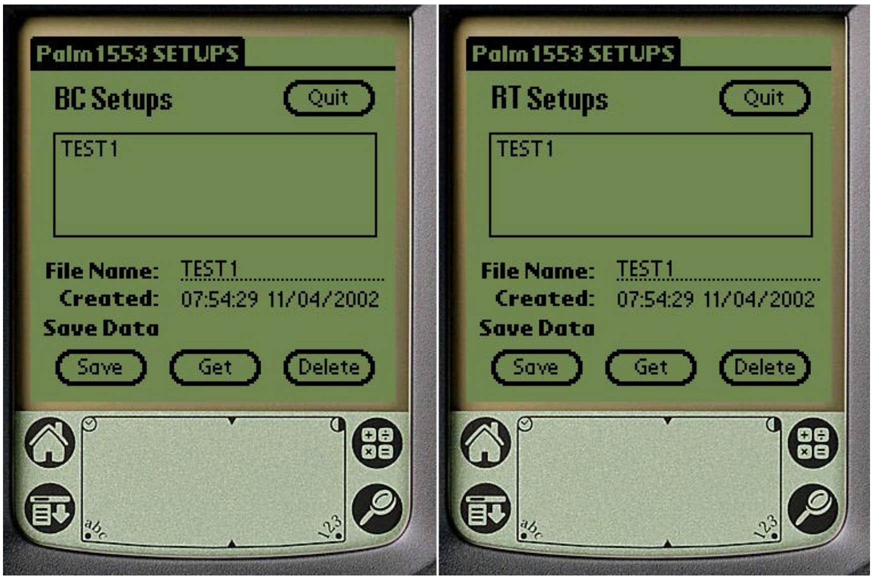


Figure 26: Palm1553 BC and RT Setup pages

The BC and RT Setup pages are identical and consist of the following:

List Box:

The list box will contain the names of all the setup databases for the particular mode. When these databases are created, they are assigned a unique identifier for the particular mode. Figure 26 shows the BC and RT setup pages with a setup database called **TEST1**. Although their names are the same, they are different databases. This mechanism ensures that a user does not attempt to recover a saved setup for the wrong operating mode.

Save button:

The **Save** button allow the user to save the current setup to a database. The database will be saved with the name as defined in the **'File Name'** text field. This field can be edited to allow the user to choose a unique name that describes the setup. Once the setup has been successfully saved, the new file name will appear in the list box.

Save Data / No Data:

Tapping on the text field above the **Save** button will toggle between two options:

Save Data	Palm1553 will save all the contents of the data buffers
No Data	Palm1553 will only save the actual setup. The data buffers will not be saved

Note: The 'Save Data' option produces a larger database and will take longer to save.

Get button:

The **Get** button allows the user to restore previously saved setups. The database name, as defined in the **'File Name'** text field, will be used to restore a setup. This field can be edited to allow the user to choose one of the databases available in the list box. Alternatively, if the user **'double-taps'** the desired file name in the list box, this name will be written to the **'File Name'** text field.

Delete button:

To delete an existing setup, first highlight the file to be deleted by tapping on the file name in the list box. Now tap on the **Delete** button and this setup will be deleted.

Created:

All the created databases have a creation time and date. When a particular database is selected, the creation time and date will appear in the 'read-only' text field to the right of the **Created** field.

Quit button:

Tapping this button will return the software back to the main menu of the current mode.

Mon Setup

When in the Monitor Main Menu, selecting the Setup option in the drop down menu will display an option select box as shown in Figure 27.



Figure 27: Palm1553 Mon Setup options

Two options are available:

Setups	The Setups option allows the user to save the trigger condition parameters
Stacks	The Stacks option allows the user to save captured stack data

Monitor Setups

The MON Setup page is shown in Figure 28.

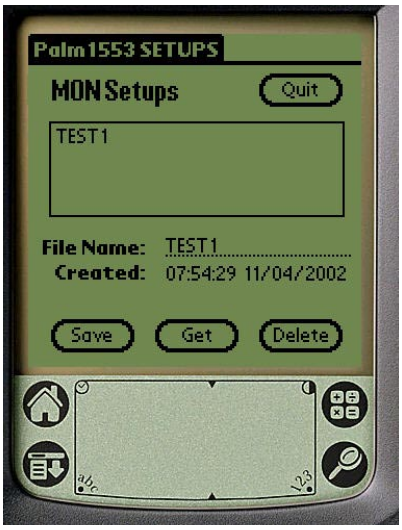


Figure 28: Palm1553 MON Setup page

The MON Setup page consists of the following:

List Box:

The list box will contain the names of all the SETUP databases for the MON mode. When these databases are created, they are assigned a unique identifier for the particular mode. This mechanism ensures that a user does not attempt to recover a saved setup for the wrong operating mode.

Save button:

The **Save** button allow the user to save the current setup to a database. The database will be saved with the name as defined in the **'File Name'** text field. This field can be edited to allow the user to choose a unique name that describes the setup. Once the setup has been successfully saved, the new file name will appear in the list box.

Get button:

The **Get** button allows the user to restore previously saved setups. The database name, as defined in the **'File Name'** text field, will be used to restore a setup. This field can be edited to allow the user to choose one of the databases available in the list box. Alternatively, if the user **'double-taps'** the desired file name in the list box, this name will be written to the **'File Name'** text field.

Delete button:

To delete an existing setup, first highlight the file to be deleted by tapping on the file name in the list box. Now tap on the **Delete** button and this setup will be deleted.

Created:

All the created databases have a creation time and date. When a particular database is selected, the creation time and date will appear in the 'read-only' text field to the right of the **Created** field.

Quit button:

Tapping this button will return the software back to the MON main menu.

Monitor Stacks

Stack database files allow the user to save up to 100 messages from the bus monitor stack.
The MON Stack files page is shown in Figure 29.

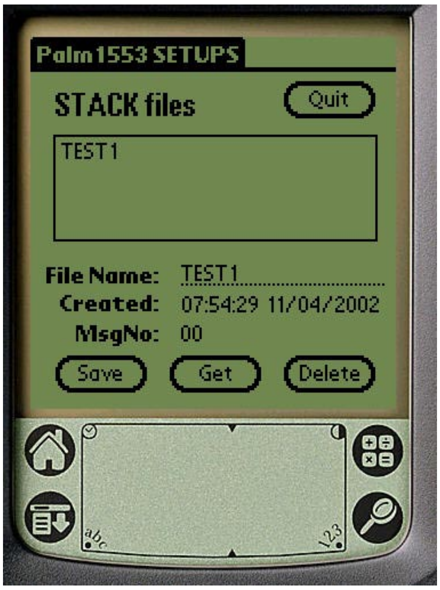


Figure 29: Palm1553 MON Stack files page

The MON Stack files page consists of the following:

List Box:

The list box will contain the names of all the STACK databases for the MON mode. When these databases are created, they are assigned a unique identifier for the particular mode. This mechanism ensures that a user does not attempt to recover a saved setup for the wrong operating mode.

MsgNo:

The Stack file can save up to 100 messages from the Bus Monitor stack. This field can be edited to define the start of the data within the stack. This value must be in the range 0 – 49. The value 49 defines the start of data at message –49 (49 messages before the trigger occurred). A value of 0 will result in saving 100 messages starting at the trigger message.

Save button:

The **Save** button allows the user to save current stack data to a database. The database will be saved with the name as defined in the **'File Name'** text field. This field can be edited to allow the user to choose a unique name that describes the setup. Once the stack data has been successfully saved, the new file name will appear in the list box.

Get button:

The **Get** button allows the user to restore previously saved stack data. The database name, as defined in the **'File Name'** text field, will be used to restore a stack file. This field can be edited to allow the user to choose one of the databases available in the list box. Alternatively, if the user **'double-taps'** the desired file name in the list box, this name will be written to the **'File Name'** text field.

Delete button:

To delete an existing stack file, first highlight the file to be deleted by tapping on the file name in the list box. Now tap on the **Delete** button and this setup will be deleted.

Created:

All the created databases have a creation time and date. When a particular database is selected, the creation time and date will appear in the 'read-only' text field to the right of the **Created** field.

Quit button:

Tapping this button will return the software back to the MON main menu.